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PHILIPS

FET PROBE PM 9354

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PHILIPS

MANUAL

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1. General information

1.1. INTRODUCTION

The DC - 1 GHz FET PROBE PM 9354 is an active high input impedance probe with 2:1 attenuation, intended for use with 50 Ω input oscilloscopes or other 50 Ω input instruments such as counters, spectrum analysers etc.
If high impedance instruments are used, an appropriate 50 Ω adaptor should be inserted.

Fig. 1.1. DC - 1 GHz FET Probe PM 9354

Environmental characteristic	Specified performance	Additional information
1.2.20. Vibration, operating	30 minutes each axis; frequency varied 10 Hz - 150 Hz - 10 Hz in ten-minute cycles; constant displacement 0.7 mm p-p from 10 Hz to 60 Hz; constant acceleration 5 g from 60 Hz to 150 Hz. Further 10 minutes each axis at any resonance point. Attachment to vibration platform by means of a GR874 connector at one end and a mini connector at the other end	Test procedure IEC 68 test F.
1.2.21. Shock, non-operating	Probe withstands 1,000 bumps each axis of half sine waves with a peak acceleration of 10 g. Attachment to shock platform by means of GR874 connector at one end and a mini connector at the other end	Test procedure IEC 50 A (CO) 110
1.2.21. Transport		
Package drop	1 m on each corner and each flat surface, 12 drops in total	
Package toppling	10 minutes each axis at a frequency of 7 kHz and an amplitude of 7 mm	

Mechanical characteristic	Specified quantity			Additional information
1.2.22. Dimensions	L	W	H	
Probe tip assy	100	10	- mm	
Compensation box	58	36	50 mm	exclusive connector
Test cable	1500	-	- mm	from amplifier box to probe tip
Power cable	160	-	- mm	
Attenuators	60	10	- mm	
Carrying case	280	185	42 mm	
1.2.23. Weight	800 g			Probe in carrying case inclusive accessories
	1200 g			Shipping

1.3. STANDARD ACCESSORIES

1	Attenuator 5:1
1	Attenuator 25:1
1	Attenuator 100:1
1	Test hook
1	Adjustable earthing attachment
1	Earthing cord
1	Adapter to BNC or N connectors
2	Mini connectors
5	Soldering terminals
5	Earthing clips
2	Spare sleeves for test hook
3	Spare attenuator tips
1	Spare probe tip
1	Probe holder
1	Carrying case with insert
1	Manual
1	Short-form manual

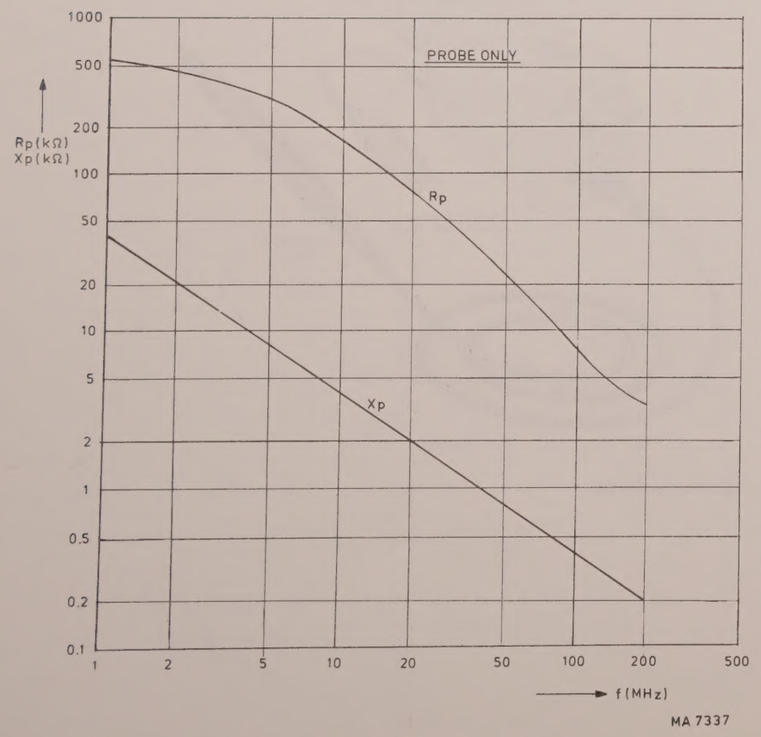
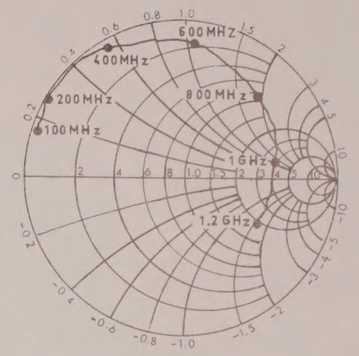
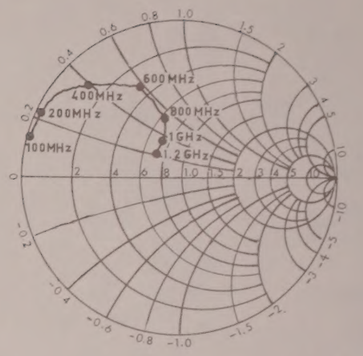


Fig. 1.2. Input resistance (Rp) and reactance (Xp) versus frequency from 1 - 200 MHz

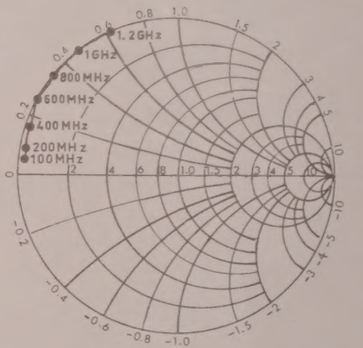


PROBE ONLY



PROBE + 5:1 ATTENUATOR

PROBE + 25:1 ATTENUATOR



PROBE + 100:1 ATTENUATOR

Fig. 1.3. Input admittance 100 MHz - 1.2 G Hz (Centre value : 20 mS)

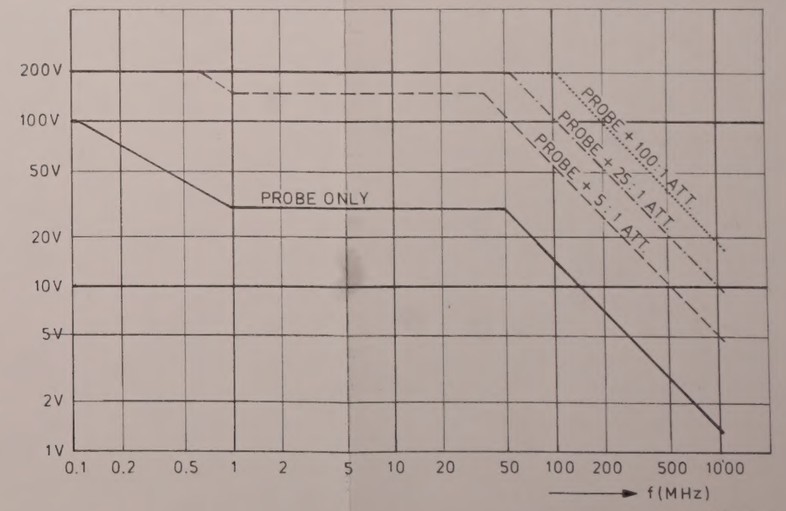


Fig. 1.4. Max input voltage derating versus frequency

2. Directions for use

2.1. GENERAL

Make sure that the input of the oscilloscope you intend to use with the FET probe has 50 Ohm impedance being provided with a 874 type GR connector. If not, insert an appropriate adaptor. If the oscilloscope to be used is not provided with a probe power outlet, auxiliary power supply PM 9346 (option 1) may be used.

2.2. SETTING UP PROCEDURE

Connect the FET probe to its oscilloscope as follows:

- Couple the GR connector of the probe with the input of the oscilloscope
- Insert the power supply plug into the PROBE POWER socket of the oscilloscope (or connect it to the auxiliary power supply)

2.3. INITIAL OFFSET ADJUSTMENT

The following adjustment must be made in order to ensure accurate operation of the probe:

- Display a time-base line and shift it to a convenient place on the screen as a zero reference
- Set the Y deflection coefficient of the oscilloscope to 200 mV/div.
- Shift the time-base line to the zero reference position, using OFFSET control R1 (Coarse) and R2 (Fine); increasing the Y sensitivity of the oscilloscope may facilitate this adjustment

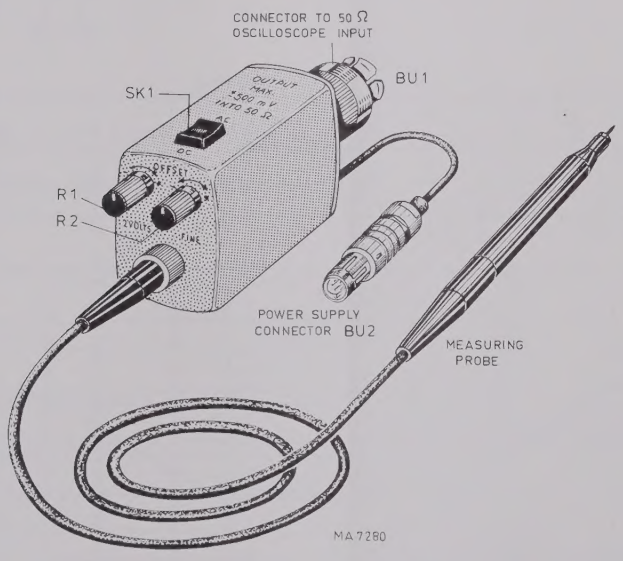


Fig. 2.1. Controls and sockets

2.4. MEASUREMENTS

During the measurements, the limitations of the probe as regards voltage derating as a function of frequency (Fig. 1.4.) should be borne in mind.
Normally, the measurements are restricted to + and -1 V with respect to earth. These limits are extended by a factor 5-25-100, when the slip-on attenuators are used.
As d.c. voltages up to + or -2 V can be compensated for, using OFFSET control R1 and R2, it is possible to obtain a display in the screen centre of a ripple voltage superimposed on + or -2 V, without switching over to a.c. coupling. It is self-evident that the control range of R1 and R2 will be 5-25-100 times as large, when the slip-on attenuators are used. The ripple, of course, will be attenuated by a factor 5-25-100 in that case.

If the probe is to be used for a.c. measurements, it is advisable to set the OFFSET controls to their zero position (approximately mid-range) before switching over to a.c. coupling. This prevents the trace from disappearing when the coupling switch is set back to d.c. coupling.

2.5. INFORMATION ON ACCESSORIES

Attenuator 5:1 (Fig. 2.2. item 1)

This slip-on attenuator increases the dynamic range of the probe by a factor 5. The attenuator and the probe are joined by means of a plug and socket connection.

Attenuator 25:1 (Fig. 2.2. item 2)

This slip-on attenuator increases the dynamic range of the probe by a factor 25. The attenuator and the probe are joined by means of a plug and socket connection.

Attenuator 100:1 (Fig. 2.2. item 3)

This slip-on attenuator increases the dynamic range of the probe by a factor 100. The attenuator and the probe are joined by means of a plug and socket connection.

Test hook (Fig. 2.2. item 4)

The test hook can be slid over the probe. By pushing the probe deeper in the test hook, the hook will protrude so that the test point can be gripped.

Earth lead (Fig. 2.2. item 5)

The fork of the earth lead is pushed on to the metal part of the probe tip. The crocodile clip is connected to the earthing point of the circuit under test.

Adjustable earthing attachment (Fig. 2.2. item 6)

This attachment facilitates short signal and earth connections.

Mini-connector (Fig. 2.2. item 7)

These mini-connectors may be incorporated into a circuit as routine test points. Earthing the outer shell of the mini-connector obviates the use of the earth lead.

Adapter for BNC or N connectors (Fig. 2.2. item 8)

This adapter allows direct connection of the probe to a BNC or N connector. This adapter obviates the use of the earth lead.

Soldering terminals (Fig. 2.2. item 9)

When there is no place to use the test hook, you can solder these terminals in the circuit. The pin of the probe tip fits in these terminals. They must not be soldered on to the tip of the probe.

Earthing clips (Fig. 2.2. item 10)

These clips can be used together with the soldering terminals to provide a measuring earth, and support for the probe.

Spare sleeve for test hook (Fig. 2.2. item 11)

These test hook sleeves are supplied with the probe, to serve as replacement for damaged parts. See also 3.2.5.

Spare tips for probe and attenuators (Fig. 2.2. items 12 and 13)

These tips are supplied with the probe, to serve as replacements for damaged parts.
See also 3.2.1. and 3.2.4.

Probe holder (Fig. 2.2. item 14)

The probe holder is pushed over the probe cable, close to the amplifier box. During a break in the measurements the probe cable close to the probe body can be pushed into the vacant slit of the probe holder. (Fig. 2.3.)

The probe holder can also be used to take the weight off the probe when it is permanently connected to a circuit (Fig. 2.3.).

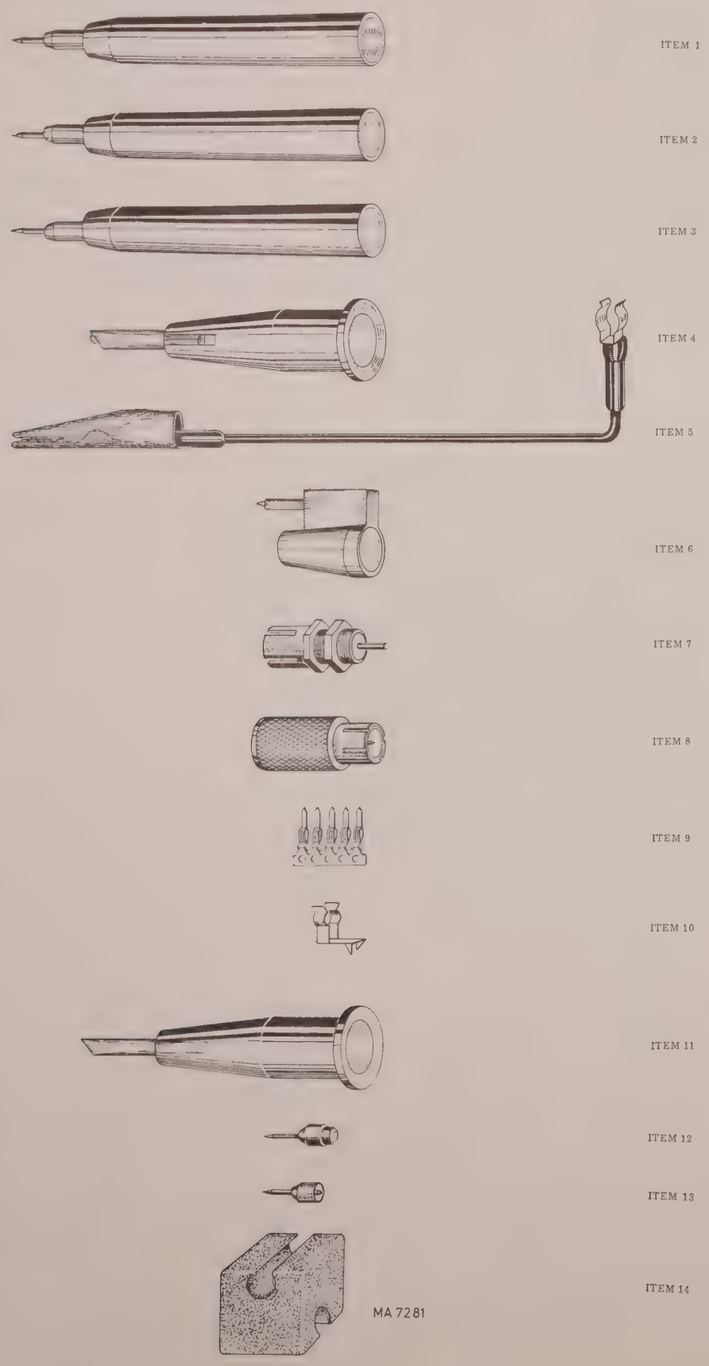


Fig. 2.2. Accessories

Fig. 2.3. Use of the probe holder

3.Service data

3.1. CIRCUIT DESCRIPTION

3.1.1. General

The input signal E_i present at the probe tip, is split-up into two components : the HF part and the DC-LF part.

The paths followed by both components will be descriped referring to Fig. 3.2. Simplified Diagram.

3.1.2. HF path

The HF part of the input signal passes through capacitor C1, amplifier "A", which actually comprises an impedance transformer 1 MΩ to approximately 5 Ω, adjustable resistance R_S, the probe cable and the amplifier box to the measuring instrument.

Meanwhile, the amplitude of the HF signal part will be reduced to a value between 90 % E_i and 95 % E_i due to source follower TS1 and emitter followers TS3, TS4.

A further reduction takes place by voltage divider R_S-R_i.

R_S being adjustable between 40 Ω and 45 Ω, the voltage E_o developed across R_i amounts to

$$E_o = \frac{50}{50 + (40 \text{ to } 45)} \cdot (0,9 \text{ to } 0,95)\, E_i = 0,5\, E_i$$

In fact, R_S serves two purposes:

1. to adjust the overall gain to exactly 0,5.
2. to suppress reflections, thanks to both sided termination of the 50 Ω-cable.

3.1.3. DC-LF path

The DC-LF part of the input signal passes through the 1 MΩ resistor R6, the probe cable, the amplifier box, once more the probe cable and, being added to the HF part via the inverting input of amplifier "A", it now follows the HF path.

At the output side of the amplifier box the DC-LF part of the output signal E_o is picked off by voltage divider R37 and (R62, R63) //R61. From circuit Fig. 3.2 it is clear that it is a 2:1 voltage division.

Amplifier "C" reverses sign, upon which the resulting signal is combined with the signal from resistor R6. Amplifier "C" consists of operational amplifier IC2 bypassed by TS9, TS11 and TS12 to widen its response characteristics.

Neglecting the output impedance of IC2, which is, indeed, very low, we may state that the voltage developed across R51 amounts to

$$\frac{R51}{R6+R51} \cdot E_i = \frac{1}{5}\, E_i$$

On the other hand, the voltage developed across R6 amounts to

$$\frac{R6}{R6+R51} \cdot (-\tfrac{1}{2}\, E_o) = \frac{1}{1,25} \cdot -\frac{1}{4} E_i = -\frac{1}{5}\, E_i$$

The combination of both voltages is zero, but any deviation of the output (E_o) as compared with half the input ($\frac{1}{2}\, E_i$) will be greatly amplified by amplifier "B" which reverses sign, too, and feeds it back to the inverting input of amplifier "A".

The non-inverting input of amplifier "B" is a convenient point to insert a variable voltage - adjustable by OFFSET controls R1 and R2 - which can compensate a DC voltage upon which a signal of interest is riding. This DC voltage may amount to + or -2 Volts at the probe tip without deterioration of the lower LF part of the spectrum.

DC voltages up to 100 Volts can be blocked by setting the "AC-DC" switch (SK1 Fig. 2.1.) which

inserts capacitor C26 in the DC-LF path. On doing so, the output E_o is no longer compared with the input $\frac{1}{2} E_i$ as far as DC is concerned, but the output remains at an average zero level, provided that the OFFSET controls are in their zero position.

3.1.4. Adjusting elements

On studying circuit diagram Fig. 3.1 it is evident that DC adjustments must be carried out before AC adjustments, so R64 DC BALANCE must be adjusted to obtain zero voltage at the emitter of TS9 with BU1 short-circuited and R31 must be adjusted to obtain zero voltage at the output terminal of IC1 with BU1 being terminated by 50 Ω. Next the 2x attenuation can be calibrated by adjusting R63 DC GAIN.

After this the AC adjustments can be performed i.e. LF response by adjusting R17 and C24 and HF response by choosing a correct value for C8 and C11.

3.1.5. Plug-on attenuators

The plug-on attenuators are frequency-compensated resistive voltage dividers having a 5x, 25x and 100x attenuation of their own, when terminated by a 1 MΩ//3,5 pF impedance. Because the probe provides already a 2x attenuation, the overall attenuation amounts to 10x, 50x and 200x respectively.

The circuit diagrams of the attenuators are shown in Fig. 3.3.

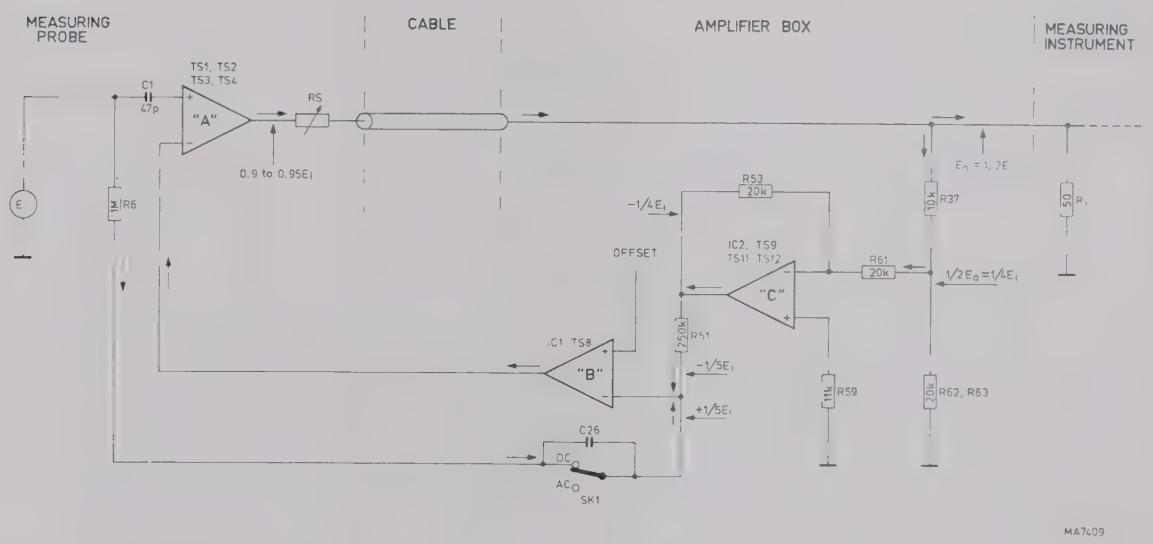


Fig. 3.2. Simplified diagram

3.2. DISMANTLING AND REPLACING PARTS

3.2.1. Probe body

The printed-wiring board in the probe body is accessible after unscrewing the shell.
BE CAREFUL NOT TO BEND THE PRINTED-WIRING BOARD as this may result in exerting undue stresses on the chip type resistors and capacitors.

The chips are fitted with silver-plated ends as connecting terminals. Using ordinary 60/40 Sn/Pb solder may cause migration of the silver from the silver-plated terminals into the solder; this results in a loss of bond strength. Therefore, a solder containing silver should be used: ordering number 5322 390 84001.

When replacing a chip, the following points should be observed:
- The soldering iron temperatures are often well above the melting point of the solder. If the chips are kept immersed for too long a period in the molten solder, the silver plating may migrate in any event.
- Corners and edges of the chips could be damaged by the use of metal tweezers; therefore, plastic ones should be used.

When the tip of the probe has been broken, it can be replaced by pulling out the damaged tip by means of a pair of pliers.
A new one (Item 13 Fig. 2.2) must be firmly pushed in.

3.2.2. Probe cable

Loose or broken soldering connections can be soldered.
We do not encourage further cable repairs and advise to replace the whole cable.
This can be done in the following way:
- remove the cover of the amplifier box according 3.2.3.
- unplug the two connectors which pass through the holes of unit 2 and remove the screws retaining unit 2 and unit 3.
- unsolder the 4 coloured wires of the measuring cable.
- unscrew the retaining ring of the GR-connector and loosen the grommet of the measuring cable.
- retract the cable assembly by pulling the GR-connector. The probe will pass the knurled nut, the cover of the amplifier box and the amplifier box frame.

Fit the new cable assembly by working in the reversed order.
- retract the cable assembly by pulling the GR-connector. The probe will pass the knurled nut, the cover of the amplifier box and the amplifier box frame.

Fit the new cable assembly by working in the reversed order.

3.2.3. Amplifier box

The cover of the amplifier box can be withdrawn after unscrewing the knobs of the OFFSET controls, when the knobcovers are prised off and after unscrewing the knurled nut at the cable.
Service work in the amplifier is easy if light tools are used.

To replace the sliding knob of the DC/AC switch the three parts: sliding knob, actuating spring and clamping spring must be pushed out of the box. The new knob can be forced home by pushing the three combined parts into the square hole, with the hammer of the actuating spring in the direction of the open end of the box. The cover must always be refitted with the DC/AC switch in position DC.

3.2.4. Attenuators

A damaged tip can be pulled out by means of a pair of pliers. A new one must be firmly pushed in. We do not encourage any further repairs as assembling the attenuators requires special tools and we advise to replace the whole attenuator.

3.2.5. Test hook

If the sleeve of the test hook is damaged, it can be pulled off whilst the hooks of the inner part are pushed in. A spare test-hook sleeve can then easily be pushed over the inner part. The wire hook should be inserted in such a way that the opening is formed by its tip and the longer side of the sleeve.

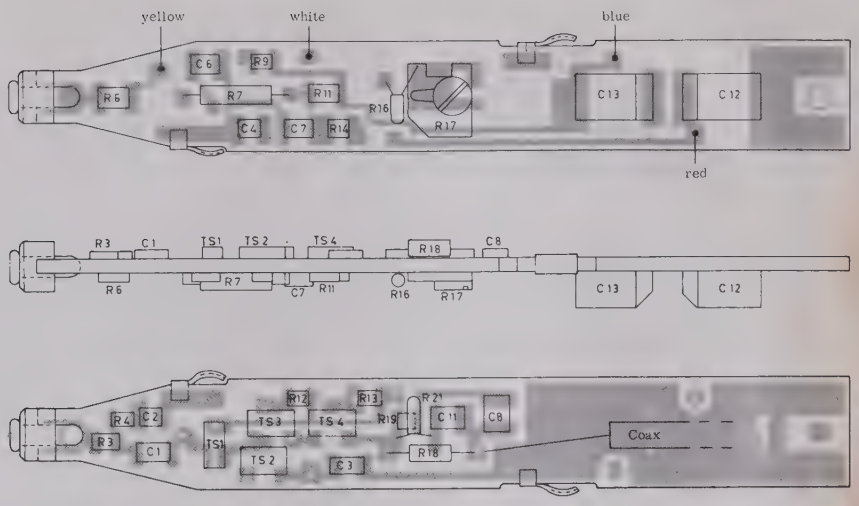


Fig. 3.4. Printed-wiring board, unit 1

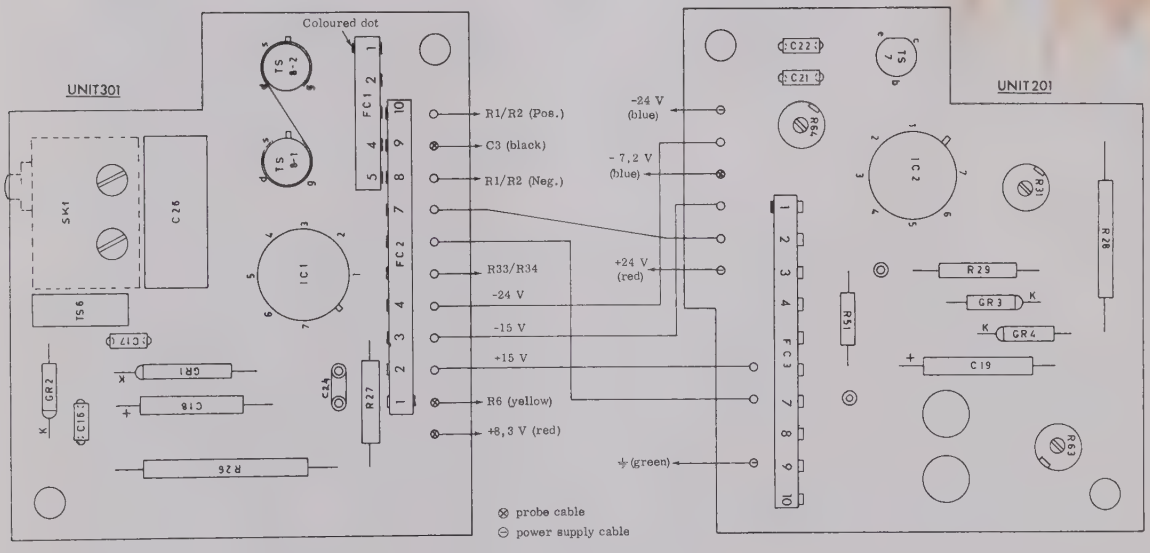


Fig. 3.5. Printed-wiring board, unit 2

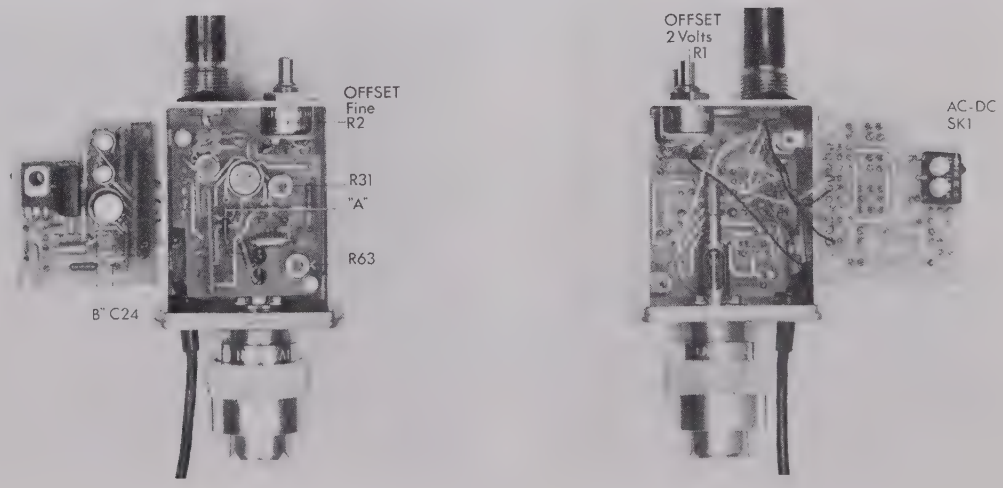


Fig. 3.6. Adjusting elements in amplifier box

3.3. CHECKING AND ADJUSTING

3.3.1. DC adjustments and DC gain (R64, R31, R63)

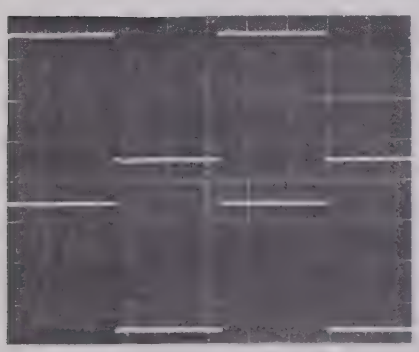
- Apply a 24 Volts positive and a 24 Volts negative supply to the power supply terminal and allow a 10 minutes warm-up time.
- Remove the cover of the amplifier box.
- Short-circuit the output socket BU1 and adjust R64 DC BALANCE to obtain 0 Volts (+ or -5 mV) at the emitter of TS9 ("A" Fig. 3-6).
- Remove the short-circuit of BU1 and connect BU1 via a 50 Ω feed-through pad to a 1 MΩ input oscilloscope, which with free-running time-base generator has its time base line adjusted to mid-screen position .
- Adjust R31 to obtain 0 Volts (+ or -10 mV) at the output of IC1 ("B" Fig. 3-6).
- Adjust OFFSET R1 and R2 to obtain 0 Volts (+ or -5 mV) at the output socket BU1 as measured by the oscilloscope.
- Apply a potential of 1 Volt positive (+ or -10 mV) to the probe tip and adjust R63 DC GAIN to obtain 0.5 Volts positive (+ or -5 mV) as measured by a DVM at the output.

3.3.2. LF Gain (R17, C24)

- Adjust the oscilloscope as listed below:
  Y-deflection : 0,1 V/div.
  X-deflection : 2 ms/div.
  Triggering : Auto-LF-pos.
- Remove the probe shell and apply a square-wave with a repetition time of 10 ms from a 50 Ω signal source; amplitude 600 mV. (3 div. display).
- Adjust R17 to obtain optimum square-wave response (see Fig. 3.7).
- Decrease the repetition time of the square-wave voltage to 1 ms and the time-base to 0,2 ms/div.
- Select a suitable value for C24 to obtain a correct square-wave response and check up to a repetition time of 1 μs.

3.3.3. Check on AC-DC switch and Offset range

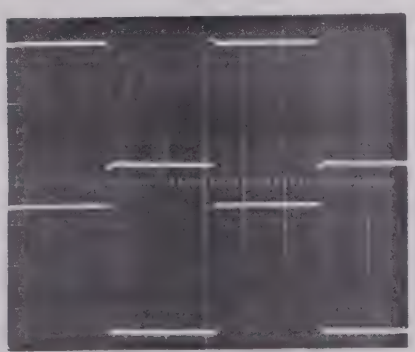
- Close the amplifier box and refit the probe shell.
- Apply a square-wave of 100 ms repetition time; time base 20 ms/div.
- Set the AC-DC switch SK1 to position AC. A display as shown in Fig. 3.9 (top) will then be obtained. Switching-over to DC gives a correct square-wave display as shown in Fig. 3.9 (bottom).
- Apply a potential of 2 Volts positive to the probe tip. The time base line can be adjusted to mid-screen position by adjusting R1 and R2 OFFSET.
- Repeat the same procedure with 2 Volts negative.



2 ms/div.

Top LF GAIN R17 incorrectly adjusted.
Bottom LF GAIN R17 correctly adjusted.

Fig. 3.7.



0,2 ms/div.

Top LF RESPONSE C24 incorrectly adjusted.
Bottom LF RESPONSE C24 correctly adjusted.

Fig. 3.8.

20 ms/div.

Top "AC-DC" switch SK1 in AC position.
Bottom "AC-DC" switch SK1 in DC postion.

Fig. 3.9.

3.3.4. HF Gain (C8, C11)

- Connect the amplifier box to a sampling oscilloscope having a 50 Ω input impedance.
- Connect the probe to a square-wave generator which delivers fast-rising signals ($t_r \approx 100$ ps); use a 50 Ω GR-probe adaptor.
- If necessary, readjust C8 and C11 (see Fig. 3.10.).

3.3.5. 5:1 Attenuator

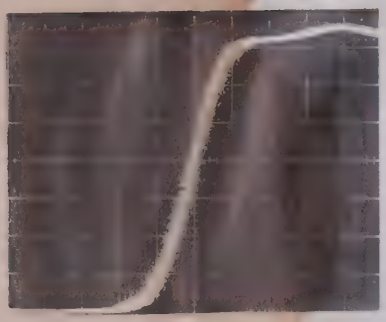
- Check the input resistance by connecting a DVM between the probe tip and the earthing bush. R = 1050 kΩ (± 2 %).
- Check the output resistance by connecting a DVM between the centre conductor at the rear side and the earthing bush. R = 250 kΩ (± 2 %).
- Connect the amplifier box to a 1 MΩ input oscilloscope using a 50 Ω feedthrough adapter.
- Adjust the trimmer (C32) to obtain an optimal square-wave response, having applied a 100 μs ($t_r \leq 1$ ns) square-wave. See Fig. 3.11.
- Connect the amplifier box to the sampling oscilloscope and apply a fastrising square-wave signal.
- Check the display having a ringing + overshoot ≤ 3 % see Fig. 3.12.

3.3.6. 25:1 Attenuator

- Check that the input resistance is 1001,7 kΩ (± 2 %).
  and the output resistance 41,7 kΩ (± 2 %).
- Adjust the trimmer (C34) according 3.3.5.
- Check for ringing + overshoot ≤ 3 % according to 3.3.5.

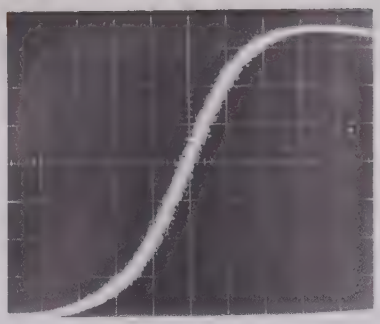
3.3.7. 100: Attenuator

- Check that the input resistance is 1000,1 kΩ (± 2 %).
  and the output resistance 10,1 kΩ (± 2 %).
- Adjust the trimmer (C38) according 3.3.5.
- Check for ringing + overshoot ≤ 3 % according 3.3.5.



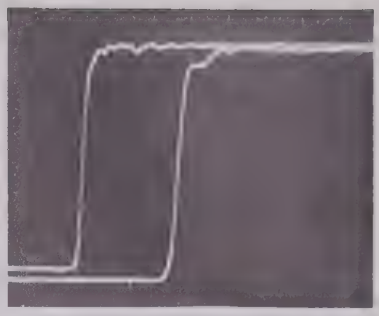
100 ps/div

A. Pulse generator directly connected to the sampling oscilloscope.



100 ps/div.

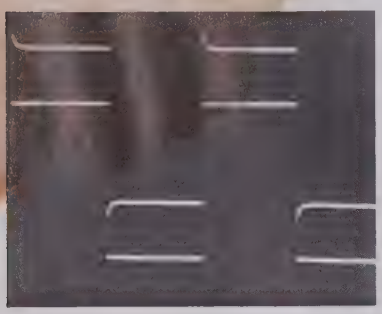
B. Pulse generator directly connected to the sampling oscilloscope via the PM 9354 probe.



1 ns/div.

C. Top:Pulse generator directly connected to the sampling oscilloscope.
Bottom:Pulse generator connected to sampling oscilloscope via the PM 9354 probe.

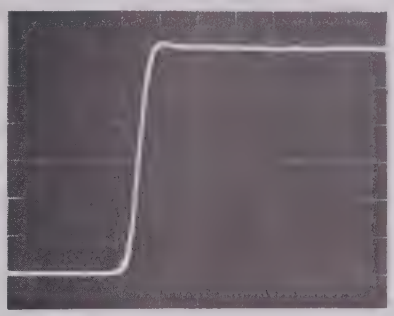
Fig. 3.10. Check on pulse response of the probe



20 μs/div.

Top: Trimmer incorrectly adjusted
Bottom: Trimmer correctly adjusted

Fig. 3.11. Adjustment of the attenuators



1 ns/div.

Pulse response of the attenuator measured with square wave $t_r \leqslant 1$ ns.

Fig. 3.12. Check on pulse response of the probe with attenuators

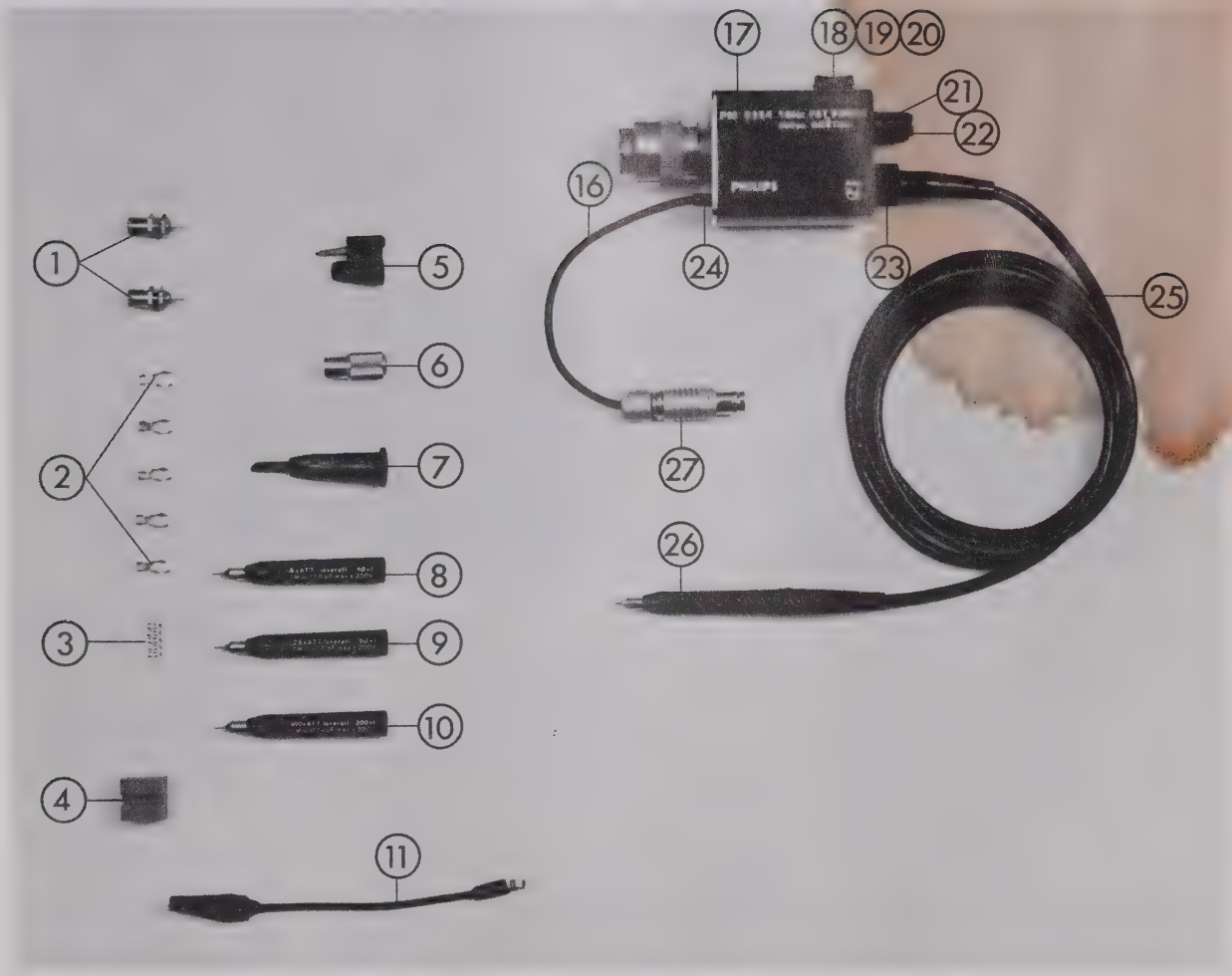


Fig. 3.13. Probe assy with item numbers

3.4. SPARE PARTS

3.4.1. MECHANICAL

Item	Fig.	Qty	Code number	Description
1	3.13.	2	5322 267 10043	Mini connector
2	3.13.	5	5322 256 94024	Earthing clip
3	3.13.	5	5322 255 44026	Soldering terminal
4	3.13.	1	5322 256 94034	Probe holder
5	3.13.	1	5322 264 24005	Adjustable earthing attachment
6	3.13.	1	5322 263 50022	Adapter to BNC and N connector
7	3.13.	1	5322 264 24004	Test hook
8	3.13.	1	5322 210 74001	5x Attenuator
9	3.13.	1	5322 210 74002	25x Attenuator
10	3.13.	1	5322 210 74003	100x Attenuator
11	3.13.	1	5322 321 24107	Earthing card
12	2.2.	2	5322 264 24006	Spare sleeve for test hook
13	2.2.	3	5322 268 14017	Spare attenuator tip
14	2.2.	1	5322 264 24007	Spare probe tip
15	-	1	5322 600 34004	Carrying case
16	3.13.	1	5322 321 24121	Supply cable (complete)
17	3.13.	1	5322 268 44044	Engraved cover
18	3.13.	1	5322 414 64008	Sliding knob
19	3.13.	1	5322 492 64268	Actuating spring
20	3.13.	1	5322 492 64269	Clamping spring
21	3.13.	2	5322 414 34091	Knob 10 Ø
22	3.13.	2	5322 414 74015	Gray cover for knob
23	3.13.	1	5322 505 14168	Nut
24	3.13.	1	5322 325 50097	Grommet
25	3.13.	1	5322 320 14012	Cable complete with GR connector
26	3.13.	1	5322 268 44043	Probe shell
27	3.13.	1	5322 266 30063	Connector (Fischer)
28	3.4	1	5322 216 54076	Probe print
29	3.5	1	5322 216 54077	Printed circuit U201
30	3.5	1	5322 216 94078	Printed circuit U301
31	3.5	1	5322 271 30078	Micro switch
32	-	1	5322 390 84001	Silver containing solder

3.4.2. Electrical parts

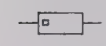
This parts list does not contain multi-purpose and standard parts. These components are indicated in the circuit diagram by means of identification marks. The specification can be derived from the survey below.

Diese Ersatzteilliste enthält keine Universal- und Standard-Teile. Diese sind im jeweiligen Prinzipschaltbild mit Kennzeichnungen versehen. Die Spezifikation kann aus nachstehender Übersicht abgeleitet werden.

In deze stuklijst zijn geen universele en standaardonderdelen opgenomen. Deze componenten zijn in het principeschema met een merkteken aangegeven. De specificatie van deze merktekens is hieronder vermeld.

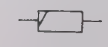
La présente liste ne contient pas des pièces universelles et standard. Celles-ci ont été repérées dans le schéma de principe. Leurs specifications sont indiquées ci-dessous.

Esta lista de componentes no comprende componentes universales ni standard. Estos componentes están provistos en el esquema de principio de una marca. El significado de estas marcas se indica a continuación.



Carbon resistor E24 series
Kohleschichtwiderstand, Reihe E24
Koolweerstand E24 reeks
Résistance au carbone, série E24
Resistencia de carbón, serie E24
0,125 W 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12
0,25 W ≦ 1 MΩ, 5%
> 1 MΩ, 10%



Carbon resistor E24 series
Kohleschichtwiderstand, Reihe E24
Koolweerstand E24 reeks
Résistance au carbone, série E24
Resistencia de carbón, serie E24
0,5 W ≦ 5 MΩ, 1%
> 5 ≦ 10 MΩ, 2%
> 10 MΩ, 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12
0,5 W ≦ 1,5MΩ, 5%
> 1,5MΩ, 10%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada
10 W 5%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12
1 W ≦ 2,2 MΩ, 5%
> 2,2 MΩ, 10%

Carbon resistor E12 series
Kohleschichtwiderstand, Reihe E12
Koolweerstand E12 reeks
Résistance au carbone, série E12
Resistencia de carbón, serie E12
2 W 5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada
0,4 – 1,8 W 0,5%

Wire-wound resistor
Drahtwiderstand
Draadgewonden weerstand
Résistance bobinée
Resistencia bobinada
5,5 W ≦ 200 Ω, 10%
> 200 Ω, 5%

Tubular ceramic capacitor
Rohrkondensator
Keramische kondensator, buistype
Condensateur céramique tubulaire
Condensador cerámico tubular
500 V

Tubular ceramic capacitor
Rohrkondensator
Keramische kondensator, buistype
Condensateur céramique tubulaire
Condensador cerámico tubular
700 V

Ceramic capacitor, "pin-up"
Keramikkondensator "Pin-up" (Perltyp)
Keramische kondensator "Pin-up" type
Condensateur céramique, type perle
Condensador cerámico, versión "colgable"
500 V

"Microplate" ceramic capacitor
Miniatur-Scheibenkondensator
"Microplate" keramische kondensator
Condensateur céramique "microplate"
Condensador cerámico "microplaca"
30 V

Mica capacitor
Glimmerkondensator
Micakondensator
Condensateur au mica
Condensador de mica
500 V

Polyester capacitor
Polyesterkondensator
Polyesterkondensator
Condensateur au polyester
Condensador polyester
400 V

Flat-foil polyester capacitor
Miniatur-Polyesterkondensator (flach)
Platte miniatuur polyesterkondensator
Condensateur au polyester, type plat
Condensador polyester, tipo de placas planas
250 V

Paper capacitor
Papierkondensator
Papierkondensator
Condensateur au papier
Condensador de papel
1000 V

Wire-wound trimmer
Drahttrimmer
Draadgewonden trimmer
Trimmer à fil
Trimmer bobinado

Tubular ceramic trimmer
Rohrtrimmer
Buisvormige keramische trimmer
Trimmer céramique tubulaire
Trimmer cerámico tubular

For multi-purpose and standard parts, please see PHILIPS' Service Catalogue.
Für die Universal- und Standard-Teile siehe den PHILIPS Service-Katalog.
Voor universele en standaardonderdelen raadplege men de PHILIPS Service Catalogus.
Pour les pièces universelles et standard veuillez consulter le Catalogue Service PHILIPS.
Para piezas universales y standard consulte el Catálogo de Servicio PHILIPS.

3.4.2.1. Capacitors

Item	Code number	Value		Volts	Description
C1	5322 122 34009	47	pF	200	CHIP
C2	5322 122 34014	1	pF	200	CHIP
C3	5322 122 34023	8,2	pF	50	CHIP
C4, C6	5322 122 34024	470	pF	50	CHIP
C7	5322 122 34025	1	pF	50	CHIP
C12, C13	5322 124 14044	1	µF	10	TANTAL
C16, C17	5322 122 30129	4,7	nF	100	PLATE
C21, C22					
C18, C19	5322 124 10018	2,2	µF	20	TANTAL
C26	4822 121 40231	0,15	µF	100	NUGGET

3 4.2.2. Resistors

I	Code number	Ω		%	Watts	Description
R1	5322 101 24035	5	k			Potentiometer
R2	5322 101 24036	10	k			Potentiometer
R3	5322 116 94007	15		10		CHIP RES
R4, 9	5322 116 94008	510		5		CHIP RES
R6	5322 116 94009	1	M	1		CHIP RES
R11	5322 116 94011	820		10		CHIP RES
R12, 19	5322 116 94012	100		10		CHIP RES
R13	5322 116 94013	130		10		CHIP RES
R14	5322 116 94014	390		10		CHIP RES
R16	5322 111 10032	180		20		Pin head
R17	5322 125 64002	2,5	k			Potentiometer
R18	5322 116 54344	43,2		1		Wire wound
R26	5322 113 44123	270		5		Wire wound
R27	5322 116 54343	5,11	k	1		Metal film
R29	5322 116 50484	4,64	k	1		Metal film
R33	5322 116 54155	100	k	1		Metal film
R34	5322 116 50748	10	k	1		Metal film
R31	5322 100 10143	1	k			Potentiometer
R28	5322 113 44124	680		5		Wire wound
R37	5322 116 54345	10	k	1		Wire wound
R67, R51	5322 116 54346	250	k	1		Wire wound
R38	5322 111 44149	820		5		Composite
R39	5322 111 44151	680		5		Composite
R63, 64	5322 100 10141	10	k	30		Potentiometer
FC1	5322 209 84233					Limiter thinfilm
FC2	5322 209 84234					DC bal thinfilm
FC3	5322 209 84235					Inverter thinfilm

3.4.2.3. Semiconductors

Item	Code number	Description
GR1, 2, 3	5322 130 30667	[illegible] BZX79/C9V1
IC1, 2	5322 209 84112	IC TBA221
TS1	5322 130 44176	Trans special
TS2	5322 130 44177	Transistor BFS20R
TS3, 4	5322 130 44178	Transistor BFR92
TS6	5322 130 40664	Transistor BD137
TS7	5322 130 44104	Transistor BC328
TS8-1, 2	5322 130 40709	Dual trans BFS21A

ERRATA

Item	Code number	Value	V/W	Description
C11	....	1-6.8 pF	50	Chip capacitor
R7	5322 111 30376	100 MΩ 5 %	1/8	Composite resistor
R21	5322 111 44154	18 Ω 10 %	1/20	Pin head resistor
R81	4822 111 10051	47 Ω 10 %	1/20	Pin head resistor
GR4	5322 130 30759	BZX79/5V6		Zener diode

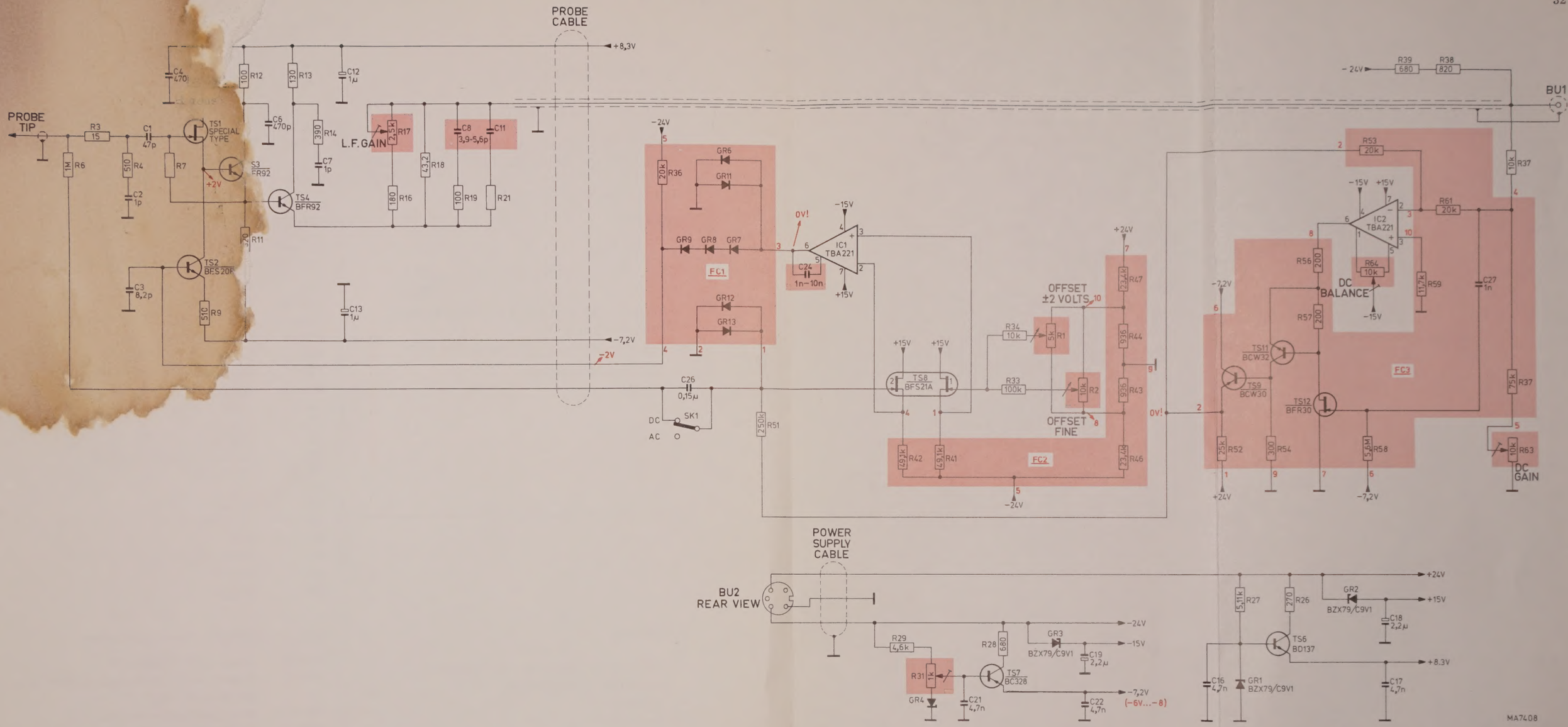


Fig. 3.1. Circuit diagram

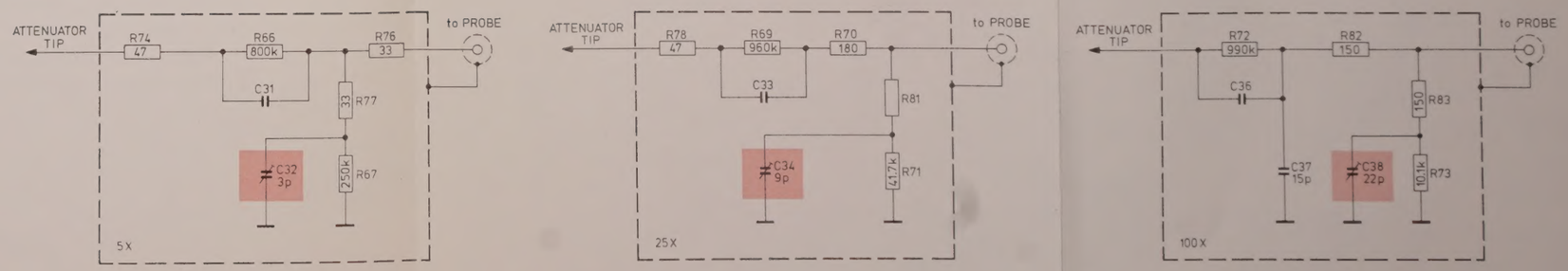


Fig. 3.3. Diagrams of the attenuators

QUALITY REPORTING

CODING SYSTEM FOR FAILURE DESCRIPTION

The following information is meant for Philips service workshops only and serves as a guide for exact reporting of service repairs and maintenance routines on the workshop charts.
For full details reference is made to Information G1 (Introduction) and Information Cd 689 (Specific information for Test and Measuring Instruments).

LOCATION

□□□
Unit number
e.g. 000A or 0001 (for unit A or 1; not 00UA or 00U1)

or: Type number of an accessory (only if delivered with the equipment)
e.g. 9051 or 9532 (for PM 9051 or PM 9532)

or: Unknown/Not applicable
0000

CATEGORY

□
0 Unknown, not applicable (fault not present, intermittent or disappeared)
1 Software error
2 Readjustment
3 Electrical repair (wiring, solder joint, etc.)
4 Mechanical repair (polishing, filing, remachining, etc.)
5 Replacement
6 Cleaning and/or lubrication
7 Operator error
8 Missing items (on pre-sale test)
9 Environmental requirements are not met

COMPONENT/SEQUENCE NUMBER

□□□□
Enter the identification as used in the circuit diagram, e.g.:

GR1003	Diode GR1003
TS0023	Transistor TS23
IC0101	Integrated circuit IC101
R0....	Resistor, potentiometer
C0....	Capacitor, variable capacitor
B0....	Tube, valve
LA....	Lamp
VL...	Fuse
SK....	Switch
BU....	Connector, socket, terminal
T0....	Transformer
L0....	Coil
X0....	Crystal
CB....	Circuit block
RE....	Relay
ME....	Meter, indicator
BA....	Battery
TR....	Chopper

Parts not identified in the circuit diagram:

990000	Unknown/Not applicable
990001	Cabinet or rack (text plate, emblem, grip, rail, graticule, etc.)
990002	Knob (incl. dial knob, cap, etc.)
990003	Probe (only if attached to instrument)
990004	Leads and associated plugs
990005	Holder (valve, transistor, fuse, board, etc.)
990006	Complete unit (p.w. board, h.t. unit, etc.)
990007	Accessory (only those without type number)
990008	Documentation (manual, supplement, etc.)
990009	Foreign object
990099	Miscellaneous

PHILIPS TEST & MEASURING INSTRUMENTS INC.
A NORTH AMERICAN PHILIPS COMPANY
224 DUFFY AVENUE
HICKSVILLE, NEW YORK 11802

DEER & MERGUNTHU INSTRUMENTS INC.
A NORTH AMERICAN PHILIPS COMPANY
224 DUFFY AVENUE
HICKSVILLE, NEW YORK 11802